

Kindergarten Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>K.1 The student will conduct investigations in which</p> <ul style="list-style-type: none"> a) basic properties of objects are identified by direct observation; b) observations are made from multiple positions to achieve different perspectives; c) objects are described both pictorially and verbally; d) a set of objects is sequenced according to size; e) a set of objects is separated into two groups based on a single physical attribute; f) nonstandard units are used to measure common objects; g) a question is developed from one or more observations; h) picture graphs are constructed using 10 or fewer units; i) an unseen member in a sequence of objects is predicted; and j) unusual or unexpected results in an activity are recognized. 	<p>K.1 The student will conduct investigations in which</p> <ul style="list-style-type: none"> a) basic properties of objects are identified by direct observation; b) observations are made from multiple positions to achieve different perspectives; c) objects are described both pictorially and verbally; d) a set of objects is sequenced according to size; e) a set of objects is separated into two groups based on a single physical attribute; f) nonstandard units are used to measure common objects; g) a question is developed from one or more observations; h) picture graphs are constructed using 10 or fewer units; i) an unseen member in a sequence of objects is predicted; and j) unusual or unexpected results in an activity are recognized.
<p>K.2 Students will investigate and understand that humans have senses that allow one to seek, find, take in, and react or respond to information in order to learn about one's surroundings. Key concepts include</p> <ul style="list-style-type: none"> a) five senses and corresponding sensing organs (taste – tongue, touch – skin, smell – nose, hearing – ears, and sight – eyes); and a) sensory descriptors (sweet, sour, bitter, salty, rough/smooth, hard/soft, cold, warm, hot, loud/soft, high/low, bright/dull). 	<p>K.2 Students will investigate and understand that humans have senses including sight, smell, hearing, touch, and taste. Senses that allow one to seek, find, take in, and react or respond to information in order to learn about one's surroundings. Key concepts include:</p> <ul style="list-style-type: none"> a) five senses <u>and corresponding sensing organ</u> (taste-<u>tongue</u>, touch-<u>skin</u>, smell-<u>nose</u>, hearing-<u>ears</u>, and sight-<u>eyes</u>); and • sensing organs associated with each of the senses (eyes, ears, nose, tongue, and skin); and b) sensory descriptors (sweet, sour, bitter, salty, rough-<u>smooth</u>, hard-<u>soft</u>, cold, warm, hot, loud-<u>soft</u>, high-<u>low</u>, bright-<u>dull</u>)

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Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>K.3 The student will investigate and understand that magnets have an effect on some materials, make some things move without touching them, and have useful applications. Key concepts include</p> <ul style="list-style-type: none"> a) attraction/nonattraction, push/pull, attract/repel, and metal/nonmetal; and b) useful applications (refrigerator magnet, can opener, magnetized screwdriver, and magnetic games). 	<p>K.3 The student will investigate and understand that magnets have an effect on some materials, make some things move without touching them, and have useful applications. Key concepts include</p> <ul style="list-style-type: none"> a) attraction/nonattraction, push/pull, attract/repel, and metal/nonmetal; and b) useful applications (refrigerator magnet, can opener, magnetized screwdriver, <u>and magnetic games</u>).
<p>K.4 The student will investigate and understand that the position, motion, and physical properties of an object can be described. Key concepts include</p> <ul style="list-style-type: none"> a) colors (red, orange, yellow, green, blue, purple), white, and black; b) shapes (circle, triangle, square, and rectangle) and forms (flexible/stiff, straight/curved); c) textures (rough/smooth) and feel (hard/soft); d) relative size and weight (big/little, large/small, heavy/light, wide/thin, long/short); and e) position (over/under, in/out, above/below, left/right) and speed (fast/slow). 	<p>K.4 The student will investigate and understand that objects can be described in terms of their <u>the position, motion, and</u> physical properties <u>of an object can be described</u>. Key concepts include</p> <ul style="list-style-type: none"> a) the eight basic colors <u>colors (red, orange, yellow, green, blue, purple), white, and black;</u> b) shapes (circle, triangle, square, <u>and rectangle</u>) and forms (flexible-/ stiff, straight-/ curved); c) textures (<u>rough/smooth</u>) and feel (rough, smooth, (hard-/soft); d) relative size and weight (big-/little, large-/small, heavy-/light, wide-/thin, long-/short); and e) position (<u>over-/under, in-/out, above-/below, left-/right</u>) and speed (over, under, in, out, above, below, left, right, (fast-/slow).

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2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>K.5 The student will investigate and understand that water flows and has properties that can be observed and tested. Key concepts include</p> <ul style="list-style-type: none"> a) water occurs in different states (solid, liquid, gas); b) the natural flow of water is downhill; and c) some materials float in water, while others sink. 	<p>K.5 The student will investigate and understand that water <u>flows and</u> has properties that can be observed and tested. Key concepts include</p> <ul style="list-style-type: none"> a) water occurs in different forms <u>states</u> (solid, liquid, gas); b) the natural flow of water is downhill; and c) some materials float in water while others sink.
<p>K.6 The student will investigate and understand basic needs and life processes of plants and animals. Key concepts include</p> <ul style="list-style-type: none"> a) living things change as they grow, and they need food, water, and air to survive; b) plants and animals live and die (go through a life cycle); and c) offspring of plants and animals are similar but not identical to their parents and to one another. 	<p>K.6 The student will investigate and understand basic needs and life processes of plants and animals. Key concepts include</p> <ul style="list-style-type: none"> a) living things change as they grow and need food, water, and air to survive; b) plants and animals live and die (go through a life cycle); and c) offspring of plants and animals are similar but not identical to their parents and one another.
<p>K.7 The student will investigate and understand that shadows occur when light is blocked by an object. Key concepts include</p> <ul style="list-style-type: none"> a) shadows occur in nature when sunlight is blocked by an object; and b) shadows can be produced by blocking artificial light sources. 	<p>K.7 The student will investigate and understand that shadows occur when light is blocked by an object. Key concepts include</p> <ul style="list-style-type: none"> a) shadows occur in nature when sunlight is blocked by an object; and b) shadows can be produced by blocking artificial light sources.
<p>K.8 The student will investigate and understand simple patterns in his/her daily life. Key concepts include</p> <ul style="list-style-type: none"> a) weather observations; b) the shapes and forms of many common natural objects including seeds, cones, and leaves; c) animal and plant growth; and d) home and school routines. 	<p>K.8 The student will investigate and understand simple patterns in his/her daily life. Key concepts include</p> <ul style="list-style-type: none"> a) weather observations; b) the shapes and forms of many common natural objects including seeds, cones, and leaves; c) animal and plant growth; and d) home and school routines.

Kindergarten Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>K.9 The student will investigate and understand that change occurs over time and rates may be fast or slow. Key concepts include</p> <ul style="list-style-type: none"> a) natural and human-made things may change over time; and b) changes can be noted and measured. 	<p>K.9 The student will investigate and understand that change occurs over time, and rates may be fast or slow. Key concepts include</p> <ul style="list-style-type: none"> a) natural and human-made things may change over time; and b) changes can be noted and measured.
<p>K.10 The student will investigate and understand that materials can be reused, recycled, and conserved. Key concepts include</p> <ul style="list-style-type: none"> a) materials and objects can be used over and over again; b) everyday materials can be recycled; and c) water and energy conservation at home and in school helps preserve resources for future use. 	<p>K.10 The student will investigate and understand that materials can be reused, recycled, and conserved. Key concepts include</p> <ul style="list-style-type: none"> a) identifying materials and objects can be used over and over again; b) describing everyday materials that can be recycled; and • explaining how to conserve water and energy conservation at home and in school. c) <u>water and energy conservation at home and in school helps preserve resources for future use.</u>

Grade One Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>1.1 The student will conduct investigations in which</p> <ul style="list-style-type: none"> a) differences in physical properties are observed using the senses; b) simple tools are used to enhance observations; c) objects or events are classified and arranged according to attributes or properties; d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers; e) length, mass, and volume are measured using standard and nonstandard units; f) predictions are based on patterns of observation rather than random guesses; g) simple experiments are conducted to answer questions; and h) inferences are made and conclusions are drawn about familiar objects and events. 	<p>1.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) differences in physical properties are observed using the senses; and simple instruments to enhance observations (magnifying glass); b) <u>simple instruments</u> tools are used to enhance observations (magnifying glass); c) objects or events are classified and arranged according to attributes or properties; d) observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers; e) length, mass, and volume are measured using standard and nonstandard units; f) predictions are based on patterns of observation rather than random guesses; g) simple experiments are conducted to answer questions; and h) inferences are made and conclusions are drawn about familiar objects and events.
<p>1.2 The student will investigate and understand that moving objects exhibit different kinds of motion. Key concepts include</p> <ul style="list-style-type: none"> a) objects may have straight, circular, and back-and-forth motions; b) objects may vibrate and produce sound; c) pushes or pulls can change the movement of an object; and the motion of objects may be observed in toys and in playground activities. 	<p>1.2 The student will investigate and understand that moving objects exhibit different kinds of motion. Key concepts include</p> <ul style="list-style-type: none"> a) objects may have straight, circular, and back and forth motions; b) objects <u>may vibrate and produce sound;</u> c) pushes or pulls can change the movement of an object; and d) the motion of objects may be observed in toys and in playground activities.

*Strikethroughs indicate deletions; underlines indicate additions.

Grade One Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>1.3 The student will investigate and understand how different common materials interact with water. Key concepts include</p> <ul style="list-style-type: none"> a) some liquids will separate when mixed with water, but others will not; b) some common solids will dissolve in water, but others will not; and c) some substances will dissolve more readily in hot water than in cold water. 	<p>1.3 The student will investigate and understand how different common materials interact with water. Key concepts include</p> <ul style="list-style-type: none"> a) some common liquids (vinegar) mix with water, others (oil) will not <u>some liquids will separate when mixed with water, others will not;</u> b) some everyday common solids (baking soda, powdered drink mix, sugar, salt) will dissolve <u>in water</u>, others (sand, soil, rocks) will not; and c) some substances will dissolve <u>more easily</u> readily in hot water rather than <u>in</u> cold water.
<p>1.4 The student will investigate and understand that plants have life needs and functional parts and can be classified according to certain characteristics. Key concepts include</p> <ul style="list-style-type: none"> a) needs (food, air, water, light, and a place to grow); b) parts (seeds, roots, stems, leaves, blossoms, fruits); and c) characteristics (edible/nonedible, flowering/nonflowering, evergreen/deciduous). 	<p>1.4 The student will investigate and understand that plants have life needs and functional parts and can be classified according to certain characteristics. Key concepts include</p> <ul style="list-style-type: none"> a) needs (food, air, water, light, and a place to grow); b) parts (seeds, roots, stems, leaves, blossom, fruit); and c) characteristics: (edible/nonedible, flowering/nonflowering, evergreen/deciduous).

Grade One Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>1.5 The student will investigate and understand that animals, including people, have life needs and specific physical characteristics and can be classified according to certain characteristics. Key concepts include</p> <ul style="list-style-type: none"> a) life needs (air, food, water, and a suitable place to live); b) physical characteristics (body coverings, body shape, appendages, and methods of movement); and c) other characteristics (wild/tame, water homes/land homes). 	<p>1.5 The student will investigate and understand that animals, including people, have life needs and specific physical characteristics and can be classified according to certain characteristics. Key concepts include</p> <ul style="list-style-type: none"> a) life needs (air, food, water, and a suitable place to live); b) physical characteristics (body coverings, body shape, appendages, and methods of movement); and c) <u>other</u> characteristics (wild/tame, water homes/land homes).
<p>1.6 The student will investigate and understand the basic relationships between the sun and the Earth. Key concepts include</p> <ul style="list-style-type: none"> a) the sun is the source of heat and light that warms the land, air, and water; and b) night and day are caused by the rotation of the Earth. 	<p>1.6 The student will investigate and understand the basic relationships between the sun and the Earth. Key concepts include</p> <ul style="list-style-type: none"> a) the sun is the source of heat and light that warms the land, air, and water; and b) night and day are caused by the rotation of the Earth.
<p>1.7 The student will investigate and understand the relationship of seasonal change and weather to the activities and life processes of plants and animals. Key concepts include how temperature, light, and precipitation bring about changes in</p> <ul style="list-style-type: none"> a) plants (growth, budding, falling leaves, and wilting); b) animals (behaviors, hibernation, migration, body covering, and habitat); and c) people (dress, recreation, and work). 	<p>1.7 The student will investigate and understand the relationship of seasonal change and weather to the activities and life processes of plants and animals. Key concepts include how temperature, light, and precipitation bring about changes in</p> <ul style="list-style-type: none"> a) plants (growth, budding, falling leaves, <u>and</u> wilting); b) animals (behaviors, hibernation, migration, body covering, <u>and</u> habitat); and c) people (dress, recreation, <u>and</u> work).

Grade One Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>1.8 The student will investigate and understand that natural resources are limited. Key concepts include</p> <ul style="list-style-type: none"> a) identification of natural resources (plants and animals, water, air, land, minerals, forests, and soil); b) factors that affect air and water quality; and c) recycling, reusing, and reducing consumption of natural resources. 	<p>1.8 The student will investigate and understand that natural resources are limited. Key concepts include</p> <ul style="list-style-type: none"> a) identification of natural resources (plants and animals, water, air, land, minerals, forests, and soil); b) factors that affect air and water quality; <u>and</u> c) recycling, reusing, and reducing consumption of natural resources; and. • use of land as parks and recreational facilities.

Grade Two Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>2.1 The student will conduct investigations in which</p> <ul style="list-style-type: none"> a) observation is differentiated from personal interpretation, and conclusions are drawn based on observations; b) observations are repeated to ensure accuracy; c) two or more attributes are used to classify items; d) conditions that influence a change are defined; e) length, volume, mass, and temperature measurements are made in metric units (centimeters, meters, liters, degrees Celsius, grams, kilograms) and standard English units (inches, feet, yards, cups, pints, quarts, gallons, degrees Fahrenheit, ounces, pounds); f) pictures and bar graphs are constructed using numbered axes; g) unexpected or unusual quantitative data are recognized; and h) simple physical models are constructed. 	<p>2.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) observation is differentiated from personal interpretation, and conclusions are drawn based on observations; b) observations are repeated to improve <u>ensure</u> accuracy; c) two or more attributes are used to classify items; d) conditions that influence a change are defined; e) linear <u>length</u>, volume, mass, and temperature measurements are made in metric (centimeters, meters, liters, degrees Celsius, grams, kilograms) and standard English units (inches, feet, yards, <u>cups</u>, pints, quarts, gallons, degrees Fahrenheit, ounces, pounds); f) pictures and bar graphs are constructed using numbered axes; g) unexpected or unusual quantitative data are recognized; and h) simple physical models are constructed.
<p>2.2 The student will investigate and understand that natural and artificial magnets have certain characteristics and attract specific types of metals. Key concepts include</p> <ul style="list-style-type: none"> a) magnetism, iron, magnetic/nonmagnetic, poles, attract/repel; and b) important applications of magnetism including the magnetic compass. 	<p>2.2 The student will investigate and understand that natural and artificial magnets have certain characteristics and attract specific types of metals. Key concepts include</p> <ul style="list-style-type: none"> a) magnetism, iron, magnetic/nonmagnetic, opposites, poles, attract/repel; and b) important applications including the magnetic compass.

Grade Two Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>2.3 The student will investigate and understand basic properties of solids, liquids, and gases. Key concepts include</p> <ul style="list-style-type: none"> a) mass and volume; and b) processes involved with changes in matter from one state to another (condensation, evaporation, melting, and freezing). 	<p>2.3 The student will investigate and understand basic properties of solids, liquids, and gases. Key concepts include</p> <ul style="list-style-type: none"> a) mass and volume; and b) processes involved with changes in matter from one state to another (condensation, evaporation, melting, and freezing; expanding, and contracting).
<p>2.4 The student will investigate and understand that plants and animals undergo a series of orderly changes in their life cycles. Key concepts include</p> <ul style="list-style-type: none"> a) some animals (frogs and butterflies) undergo distinct stages during their lives, while others generally resemble their parents; and b) flowering plants undergo many changes, from the formation of the flower to the development of the fruit. 	<p>2.4 The student will investigate and understand that plants and animals go through <u>undergo</u> a series of orderly changes in their life cycles. Key concepts include</p> <ul style="list-style-type: none"> a) some animals (frogs and butterflies) go through <u>undergo</u> distinct stages during their lives while others generally resemble their parents; and b) flowering plants undergo many changes from the formation of the flower to the development of the fruit
<p>2.5 The student will investigate and understand that living things are part of a system. Key concepts include</p> <ul style="list-style-type: none"> a) living organisms are interdependent with their living and nonliving surroundings; and a. habitats change over time due to many influences. 	<p>2.5 The student will investigate and understand that living things are part of a system. Key concepts include</p> <ul style="list-style-type: none"> a) living organisms are interdependent with their living and nonliving surroundings; and b) habitats change over time due to many influences.

Grade Two Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>2.6 The student will investigate and understand basic types, changes, and patterns of weather. Key concepts include</p> <ul style="list-style-type: none"> a) temperature, wind, precipitation, drought, flood, and storms; and b) the uses and importance of measuring and recording weather data. 	<p>2.6 The student will investigate and understand basic types changes and patterns of weather. Key concepts include</p> <ul style="list-style-type: none"> a) temperature, wind, condensation, precipitation, drought, flood, and storms; and b) the uses and importance of measuring and recording weather data.
<p>2.7 The student will investigate and understand that weather and seasonal changes affect plants, animals, and their surroundings. Key concepts include</p> <ul style="list-style-type: none"> a) effects on growth and behavior of living things (migration, hibernation, camouflage, adaptation, dormancy); and b) weathering and erosion of the land surface. 	<p>2.7 The student will investigate and understand that weather and seasonal changes affect plants, animals, and their surroundings. Key concepts include</p> <ul style="list-style-type: none"> a) effects on growth and behavior of living things (migration, estivation, hibernation, camouflage, adaptation, dormancy); and b) weathering and erosion of the land surface.
<p>2.8 The student will investigate and understand that plants produce oxygen and food, are a source of useful products, and provide benefits in nature. Key concepts include</p> <ul style="list-style-type: none"> a) important plant products (fiber, cotton, oil, spices, lumber, rubber, medicines, and paper); b) the availability of plant products affects the development of a geographic area; and c) plants provide homes and food for many animals and prevent soil from washing away. 	<p>2.8 The student will investigate and understand that plants produce oxygen and food, are a source of useful products, and provide benefits in nature. Key concepts include</p> <ul style="list-style-type: none"> a) important plant products (fiber, cotton, oil, spices, lumber, rubber, medicines, and paper); b) the availability of plant products affects the development of a geographic area; and c) plants provide homes and food for many animals and prevent soil from washing away.

Grade Three Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>3.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) predictions and observations are made; b) objects with similar characteristics are classified into at least two sets and two subsets; c) questions are developed to formulate hypotheses; d) volume is measured to the nearest milliliter and liter; e) length is measured to the nearest centimeter; f) mass is measured to the nearest gram; g) data are gathered, charted, and graphed (line plot, picture graph, and bar graph); h) temperature is measured to the nearest degree Celsius; i) time is measured to the nearest minute; j) inferences are made and conclusions are drawn; and k) natural events are sequenced chronologically. 	<p>3.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) predictions and observations are made; b) objects with similar characteristics are classified into at least two sets and two subsets; c) questions are developed to formulate hypotheses; d) volume is measured to the nearest milliliter and liter; e) length is measured to the nearest centimeter; f) mass is measured to the nearest gram; g) data are gathered, charted, and graphed (<u>line plot, picture graph, and bar graph</u>); h) temperature is measured to the nearest degree Celsius; i) time is measured to the nearest minute; j) inferences are made and conclusions are drawn; and k) natural events are sequenced chronologically.
<p>3.2 The student will investigate and understand simple machines and their uses. Key concepts include</p> <ul style="list-style-type: none"> a) types of simple machines (lever, screw, pulley, wheel and axle, inclined plane, and wedge); b) how simple machines function; c) compound machines (scissors, wheelbarrow, and bicycle); and d) examples of simple and compound machines found in the school, home, and work environment. 	<p>3.2 The student will investigate and understand simple machines and their uses. Key concepts include</p> <ul style="list-style-type: none"> a) types of simple machines (lever, screw, pulley, wheel and axle, inclined plane, and wedge); b) how simple machines function; c) <u>compound machines (scissors, wheelbarrow, and bicycle); and</u> d) examples of simple <u>and compound</u> machines found in the school, home, and work environment.

Grade Three Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>3.3 The student will investigate and understand that objects are made of materials that can be described by their physical properties. Key concepts include</p> <ul style="list-style-type: none"> a) objects are made of one or more materials; b) materials are composed of parts that are too small to be seen without magnification; and c) physical properties remain the same as the material is reduced in size. 	<p>3.3 The student will investigate and understand that objects can be described in terms of the materials they are made of and <u>are made of materials that can be described by their</u> physical properties. Key concepts include</p> <ul style="list-style-type: none"> a) objects are made of smaller parts <u>one or more materials</u>; b) materials are composed of parts that are too small to be seen without magnification; and c) physical properties remain the same as the material is reduced in size.
<p>3.4 The student will investigate and understand that behavioral and physical adaptations allow animals to respond to life needs. Key concepts include</p> <ul style="list-style-type: none"> a) methods of gathering and storing food, finding shelter, defending themselves, and rearing young; and b) hibernation, migration, camouflage, mimicry, instinct, and learned behavior. 	<p>3.4 The student will investigate and understand that behavioral and physical adaptations allow animals to respond to life needs. Key concepts include</p> <ul style="list-style-type: none"> a) methods of gathering and storing food, finding shelter, defending themselves, and rearing young; and b) hibernation, migration, camouflage, mimicry, instinct, and learned behavior.
<p>3.5 The student will investigate and understand relationships among organisms in aquatic and terrestrial food chains. Key concepts include</p> <ul style="list-style-type: none"> a) producer, consumer, decomposer; b) herbivore, carnivore, omnivore; and c) predator and prey. 	<p>3.5 The student will investigate and understand relationships among organisms in aquatic and terrestrial food chains. Key concepts include</p> <ul style="list-style-type: none"> a) producer, consumer, decomposer; b) herbivore, carnivore, omnivore; and c) predator - prey.

Grade Three Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>3.6 The student will investigate and understand that environments support a diversity of plants and animals that share limited resources. Key concepts include</p> <ul style="list-style-type: none"> a) water-related environments (pond, marshland, swamp, stream, river, and ocean environments); b) dry-land environments (desert, grassland, rain forest, and forest environments); and c) population and community. 	<p>3.6 The student will investigate and understand that environments support a diversity of plants and animals that share limited resources. Key concepts include</p> <ul style="list-style-type: none"> a) water-related environments (pond, marshland, swamp, stream, river, and ocean environments); b) dry-land environments (desert, grassland, rain forest, and forest environments); and c) population and community.
<p>3.7 The student will investigate and understand the major components of soil, its origin, and importance to plants and animals including humans. Key concepts include</p> <ul style="list-style-type: none"> a) soil provides the support and nutrients necessary for plant growth; b) topsoil is a natural product of subsoil and bedrock; c) rock, clay, silt, sand, and humus are components of soils; and d) soil is a natural resource and should be conserved. 	<p>3.7 The student will investigate and understand the major components of soil, its origin, and importance to plants and animals including humans. Key concepts include</p> <ul style="list-style-type: none"> a) soil provides the support and nutrients necessary for plant growth; b) topsoil is a natural product of subsoil and bedrock; c) rock, clay, silt, sand, and humus are components of soils; and d) soil is a natural resource and should be conserved.
<p>3.8 The student will investigate and understand basic patterns and cycles occurring in nature. Key concepts include</p> <ul style="list-style-type: none"> a) patterns of natural events (day and night, seasonal changes, phases of the moon, and tides); and b) animal and plant life cycles. 	<p>3.8 The student will investigate and understand basic sequences <u>patterns</u> and cycles occurring in nature. Key concepts include</p> <ul style="list-style-type: none"> a) sequences <u>patterns</u> of natural events (day and night, seasonal changes, phases of the moon, and tides); and b) animal and plant life cycles.

Grade Three Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>3.9 The student will investigate and understand the water cycle and its relationship to life on Earth. Key concepts include</p> <ul style="list-style-type: none"> a) the energy from the sun drives the water cycle; b) processes involved in the water cycle (evaporation, condensation, precipitation); c) water is essential for living things; and d) water supply and water conservation. 	<p>3.9 The student will investigate and understand the water cycle and its relationship to life on Earth. Key concepts include</p> <ul style="list-style-type: none"> a) the origin of energy that <u>the energy from the sun</u> drives the water cycle; b) processes involved in the water cycle (evaporation, condensation, precipitation); and c) <u>water is essential for living things; and</u> d) water supply and water conservation.
<p>3.10 The student will investigate and understand that natural events and human influences can affect the survival of species. Key concepts include</p> <ul style="list-style-type: none"> a) the interdependency of plants and animals; b) the effects of human activity on the quality of air, water, and habitat; c) the effects of fire, flood, disease, and erosion on organisms; and d) conservation and resource renewal. 	<p>3.10 The student will investigate and understand that natural events and human influences can affect the survival of species. Key concepts include</p> <ul style="list-style-type: none"> a) the interdependency of plants and animals; b) human effects on the quality of air, water, and habitat; c) the effects of fire, flood, disease, <u>and</u> erosion; earthquake, and volcanic eruption on organisms; and d) conservation <u>and</u>; resource renewal; habitat management, and species monitoring.
<p>3.11 The student will investigate and understand different sources of energy. Key concepts include</p> <ul style="list-style-type: none"> a) the sun's ability to produce light and heat energy; b) sources of energy (sunlight, water, wind); c) fossil fuels (coal, oil, natural gas) and wood; and d) renewable and nonrenewable energy resources. 	<p>3.11 The student will investigate and understand different sources of energy. Key concepts include</p> <ul style="list-style-type: none"> a) the sun's ability to produce light and heat energy; b) natural forms <u>sources</u> of energy (sunlight, water, wind); c) fossil fuels (coal, oil, natural gas) and wood; <u>and</u> electricity, nuclear power; and d) renewable and nonrenewable <u>energy</u> resources.

Grade Four Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>4.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) distinctions are made among observations, conclusions, inferences, and predictions; b) hypotheses are formulated based on cause-and-effect relationships; c) variables that must be held constant in an experimental situation are defined; d) appropriate instruments are selected to measure linear distance, volume, mass, and temperature; e) appropriate metric measures are used to collect, record, and report data; f) data are displayed using bar and basic line graphs; g) numerical data that are contradictory or unusual in experimental results are recognized; and h) predictions are made based on data from picture graphs, bar graphs, and basic line graphs. 	<p>4.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) distinctions are made among observations, conclusions, (inferences), and predictions; b) hypotheses are formulated based on cause and effect relationships; c) variables that must be held constant in an experimental situation are defined; d) appropriate instruments are selected to measure linear distance, volume, mass, and temperature; e) appropriate metric measures are used to collect, record, and report data; f) data are classified to create frequency distributions <u>displayed using bar and basic line graphs</u>; g) numerical data that are contradictory or unusual in experimental results are recognized; and h) predictions are made based on data from picture graphs, bar graphs, and basic line graphs.

Grade Four Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>4.2 The student will investigate and understand characteristics and interaction of moving objects. Key concepts include</p> <ul style="list-style-type: none"> a) motion is described by an object's direction and speed; b) forces cause changes in motion; c) friction is a force that opposes motion; and d) moving objects have kinetic energy. 	<p>4.2 The student will investigate and understand <u>characteristics and interaction of moving objects</u> that energy is needed to do work and that machines make work easier. Key concepts include</p> <ul style="list-style-type: none"> • energy forms (electrical, mechanical, and chemical energy); • potential and kinetic energy; • simple and complex machines and • efficiency, friction, and inertia a) <u>motion is described by an object's direction and speed;</u> b) <u>forces cause changes in motion;</u> c) <u>friction is a force that opposes motion; and</u> d) <u>moving objects have kinetic energy.</u>
<p>4.3 The student will investigate and understand the characteristics of electricity. Key concepts include</p> <ul style="list-style-type: none"> a) conductors and insulators; b) basic circuits (open/closed, parallel/series); c) static electricity; d) the ability of electrical energy to be transformed into heat, light, and mechanical energy; e) simple electromagnets and magnetism; and f) historical contributions in understanding electricity. 	<p>4.3 The student will investigate and understand the characteristics of electricity. Key concepts include</p> <ul style="list-style-type: none"> a) the nature of electricity (voltage, ampere, resistance, conductors, and insulators); b) <u>basic</u> circuits (open/closed, parallel/series); • magnetism and magnetic fields; c) static electricity; and d) <u>the ability of electrical energy to be transformed into heat, light, and mechanical energy;</u> e) <u>simple electromagnets and magnetism; and</u> f) historical contributions in understanding electricity.

Grade Four Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>4.4 The student will investigate and understand basic plant anatomy and life processes. Key concepts include</p> <ul style="list-style-type: none"> a) the structures of typical plants (leaves, stems, roots, and flowers); b) processes and structures involved with reproduction (pollination, stamen, pistil, sepal, embryo, spore, and seed); c) photosynthesis (sunlight, chlorophyll, water, carbon dioxide, oxygen, and sugar); and d) dormancy. 	<p>4.4 The student will investigate and understand basic plant anatomy and life processes. Key concepts include</p> <ul style="list-style-type: none"> a) the structures of typical plants (leaves, stems, roots, and flowers); b) processes and structures involved with reproduction (pollination, stamen, pistil, sepal, embryo, spore, and seed); c) photosynthesis (<u>sunlight, chlorophyll, water, carbon dioxide, oxygen, and sugar</u>); and d) dormancy.
<p>4.5 The student will investigate and understand how plants and animals in an ecosystem interact with one another and the nonliving environment. Key concepts include</p> <ul style="list-style-type: none"> a) behavioral and structural adaptations; b) organization of communities; c) flow of energy through food webs; d) habitats and niches; e) life cycles; and f) influence of human activity on ecosystems 	<p>4.5 The student will investigate and understand how plants and animals in an ecosystem interact with one another and the nonliving environment. Key concepts include</p> <ul style="list-style-type: none"> a) behavioral and structural adaptations; b) organization of communities; c) flow of energy through food webs; d) habitats and niches; e) life cycles; and f) influence of human activity on ecosystems.
<p>4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include</p> <ul style="list-style-type: none"> a) weather measurements and meteorological tools (air pressure – barometer, wind speed – anemometer, rainfall – rain gauge, and temperature – thermometer); and b) weather phenomena (fronts, clouds, and storms). 	<p>4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include</p> <ul style="list-style-type: none"> • weather factors (temperature, air pressure, fronts, formation and type of clouds, and storms); and a) <u>weather measurements and meteorological tools (air pressure-barometer, hygrometer, wind speed-anemometer, <u>rainfall</u>-rain gauge, and <u>temperature</u>-thermometer); and</u> b) <u>weather phenomena (fronts, clouds, and storms).</u>

*Strikethroughs indicate deletions; underlines indicate additions.

Grade Four Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>4.7 The student will investigate and understand the relationships among the Earth, moon, and sun. Key concepts include</p> <ul style="list-style-type: none"> a) the motions of the Earth, moon, and sun (revolution and rotation); b) the causes for the Earth's seasons and phases of the moon; c) the relative size, position, age, and makeup of the Earth, moon, and sun; and d) historical contributions in understanding the Earth-moon-sun system. 	<p>4.7 The student will investigate and understand the relationships among the Earth, moon, and sun. Key concepts include</p> <ul style="list-style-type: none"> a) the motions of the Earth, moon, and sun (revolution and rotation); b) the causes for the Earth's seasons and phases of the moon; c) the relative size, position, <u>age</u>, and makeup of the Earth, moon, and sun; <u>and</u> • unique properties of the Earth as a planet and as part of the solar system; and d) historical contributions in understanding the Earth-moon-sun system.
<p>4.8 The student will investigate and understand important Virginia natural resources. Key concepts include</p> <ul style="list-style-type: none"> a) watershed and water resources; b) animals and plants; c) minerals, rocks, ores, and energy sources; and d) forests, soil, and land. 	<p>4.8 The student will investigate and understand important Virginia natural resources. Key concepts include</p> <ul style="list-style-type: none"> a) watershed and water resources; b) animals and plants, both domesticated and wild; c) minerals, rocks, ores, and energy sources; and d) forests, soil, and land.

Grade Five Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>5.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) rocks, minerals, and organisms are identified using a classification key; b) estimations of length, mass, and volume are made; c) appropriate instruments are selected and used for making quantitative observations of length, mass, volume, and elapsed time; d) accurate measurements are made using basic tools (thermometer, meter stick, balance, graduated cylinder); e) data are collected, recorded, and reported using the appropriate graphical representation (graphs, charts, diagrams); f) predictions are made using patterns, and simple graphical data are extrapolated; g) manipulated and responding variables are identified; and h) an understanding of the nature of science is developed and reinforced. 	<p>5.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) rocks, minerals, and organisms are identified using a classification key; b) estimations of length, mass, and volume are made; c) appropriate instruments are selected and used for making quantitative observations of length, mass, volume, and elapsed time; d) accurate measurements are made using basic tools (thermometer, meter stick, balance, graduated cylinder); e) data are collected, recorded, and reported using the appropriate graphical representation (graphs, charts, diagrams); f) predictions are made using patterns, and simple graphical data are extrapolated; g) <u>manipulated and responding variables are identified; and</u> h) <u>an understanding of the nature of science is developed and reinforced.</u>

Grade Five Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>5.2 The student will investigate and understand how sound is transmitted and is used as a means of communication. Key concepts include</p> <ul style="list-style-type: none"> a) frequency, waves, wavelength, vibration; b) the ability of different media (solids, liquids, and gases) to transmit sound; and c) uses and applications (voice, sonar, animal sounds, and musical instruments). 	<p>5.2 The student will investigate and understand how sound is transmitted and is used as a means of communication. Key concepts include</p> <ul style="list-style-type: none"> a) frequency, waves, wavelength, resonance, vibration; b) the ability of different media (solids, liquids, <u>and</u> gases) to transmit sound; and c) communication tools <u>uses and applications</u> (voice, Morse code, sonar, animal sounds, musical instruments).
<p>5.3 The student will investigate and understand basic characteristics of visible light and how it behaves. Key concepts include</p> <ul style="list-style-type: none"> a) the visible spectrum and light waves; b) refraction of light through water and prisms; c) reflection of light from reflective surfaces (mirrors); d) opaque, transparent, and translucent; and a) historical contributions in understanding light. 	<p>5.3 The student will investigate and understand basic characteristics of white <u>visible</u> light <u>and</u> how it behaves. Key concepts include</p> <ul style="list-style-type: none"> a) the visible spectrum <u>and</u>, light waves, reflection, refraction, diffraction, opaque, transparent, translucent; • optical tools (eyeglasses, lenses, flashlight, camera, kaleidoscope, binoculars, microscope, light boxes, telescope, prism, spectroscope, mirrors); and b) <u>refraction of light through water and prisms</u>; c) <u>reflection of light from reflective surfaces (mirrors)</u>; d) <u>opaque, transparent, and translucent; and</u> e) historical contributions in understanding light.

Grade Five Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>5.4 The student will investigate and understand that matter is anything that has mass, takes up space, and occurs as a solid, liquid, or gas. Key concepts include</p> <ul style="list-style-type: none"> a) atoms, elements, molecules, and compounds; b) mixtures including solutions; and c) the effect of heat on the states of matter. 	<p>5.4 The student will investigate and understand that matter is anything that has mass; takes up space; and occurs as a solid, liquid, or gas. Key concepts include</p> <ul style="list-style-type: none"> • atoms, molecules, elements, and compounds; a) atoms, elements, <u>molecules, and</u> compounds; b) mixtures and including solutions; and c) effect of temperature <u>heat</u> on the states of matter.
<p>5.5 The student will investigate and understand that organisms are made of cells and have distinguishing characteristics. Key concepts include</p> <ul style="list-style-type: none"> a) basic cell structures and functions; b) kingdoms of living things; c) vascular and nonvascular plants; and d) vertebrates and invertebrates. 	<p>5.5 The student will investigate and understand that organisms are made of cells and have distinguishing characteristics. Key concepts include</p> <ul style="list-style-type: none"> a) parts of a cell <u>basic cell structures and functions</u>; b) kingdoms of living things; c) vascular and nonvascular plants; and d) vertebrates and invertebrates.
<p>5.6 The student will investigate and understand characteristics of the ocean environment. Key concepts include</p> <ul style="list-style-type: none"> a) geological characteristics (continental shelf, slope, rise); b) physical characteristics (depth, salinity, major currents); and c) biological characteristics (ecosystems). 	<p>5.6 The student will investigate and understand characteristics of the ocean environment. Key concepts include</p> <ul style="list-style-type: none"> a) geological characteristics (continental shelf, slope, rise); b) physical characteristics (depth, salinity, major currents); <u>and</u> c) biological characteristics (ecosystems) and. • public policy decisions related to the ocean environment (assessment of marine organism populations, pollution prevention).

Grade Five Science Standards of Learning **Crosswalk between the 2003 and 1995 Standards**

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>5.7 The student will investigate and understand how the Earth's surface is constantly changing. Key concepts include</p> <ul style="list-style-type: none"> a) the rock cycle including identification of rock types; b) Earth history and fossil evidence; c) the basic structure of the Earth's interior; d) plate tectonics (earthquakes and volcanoes); e) weathering and erosion; and f) human impact. 	<p>5.7 The student will investigate and understand how the Earth's surface is constantly changing. Key concepts include</p> <ul style="list-style-type: none"> a) the rock cycle including the identification of rock types; b) Earth history and fossil evidence; c) the basic structure of the Earth's interior; d) plate tectonics (earthquakes and volcanoes); e) weathering and erosion; and f) human impact.

Grade Six Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>6.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) observations are made involving fine discrimination between similar objects and organisms; b) a classification system is developed based on multiple attributes; c) precise and approximate measurements are recorded; d) scale models are used to estimate distance, volume, and quantity; e) hypotheses are stated in ways that identify the independent (manipulated) and dependent (responding) variables; f) a method is devised to test the validity of predictions and inferences; g) one variable is manipulated over time, using many repeated trials; h) data are collected, recorded, analyzed, and reported using appropriate metric measurements; i) data are organized and communicated through graphical representation (graphs, charts, and diagrams); j) models are designed to explain a sequence; and k) an understanding of the nature of science is developed and reinforced. 	<p>6.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) observations are made involving fine discrimination between similar objects and organisms; b) a classification system is developed based on multiple attributes; • differences in descriptions and working definitions are made; c) precise and approximate measures are recorded; d) scale models are used to estimate distance, volume, and quantity; e) hypotheses are stated in ways that identify the independent (manipulated) and dependent (responding) variables; f) a method is devised to test the validity of predictions and inferences; g) one variable is manipulated over time with many repeated trials; h) data are collected, recorded, analyzed, and reported using appropriate metric measurement; i) data are organized and communicated through graphical representation (graphs, charts, and diagrams); and j) models are designed to explain a sequence-; <u>and</u> k) <u>an understanding of the nature of science is developed and reinforced.</u>

Grade Six Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
	<p>6.2 The student will demonstrate scientific reasoning and logic. Key concepts include</p> <ul style="list-style-type: none"> • ideas are investigated by asking for and actively seeking information; • multiple tests of ideas are performed before accepting or rejecting them; • alternative scientific explanations are analyzed; and • conclusions are based on scientific evidence obtained from a variety of sources.
<p>6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include</p> <ol style="list-style-type: none"> a) potential and kinetic energy; b) the role of the sun in the formation of most energy sources on Earth; c) nonrenewable energy sources (fossil fuels including petroleum, natural gas, and coal); d) renewable energy sources (wood, wind, hydro, geothermal, tidal, and solar); and e) energy transformations (heat/light to mechanical, chemical, and electrical energy). 	<p>6.32 The student will investigate and understand <u>basic</u> sources of energy, and their <u>origins</u>, transformations, <u>and uses</u>. Key concepts include</p> <ol style="list-style-type: none"> a) potential and kinetic energy; b) <u>the role of the sun in the formation of most energy sources on Earth;</u> c) <u>nonrenewable</u> energy sources (fossil fuels, <u>including petroleum, natural gas, and coal</u> wood, wind, water, solar, and nuclear power); and d) <u>renewable energy sources (wood, wind, hydro, geothermal, tidal, and solar); and</u> e) energy transformations (<u>heat/light to mechanical, chemical, and electrical energy</u> to electrical, electrical to heat/light, chemical to light, and chemical to electrical/light).

Grade Six Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
	<p>6.4 The student will investigate and understand basic characteristics of electricity. Key concepts include</p> <ul style="list-style-type: none"> • electrical energy can be produced from a variety of energy sources and can be transformed into almost any other form of energy; • electricity is related to magnetism; • currents are either alternating or direct; • circuits can be parallel or series; • electrical energy can be described in volts and amps; and • electrical energy consumption is measured using common units (kilowatts/kilowatt hours). <p><i>(Content is Physical Science PS.11.)</i></p>
<p>6.3 The student will investigate and understand the role of solar energy in driving most natural processes within the atmosphere, the hydrosphere, and on the Earth's surface. Key concepts include</p> <ol style="list-style-type: none"> a) the Earth's energy budget; b) the role of radiation and convection in the distribution of energy; c) the motion of the atmosphere and the oceans; d) cloud formation; and e) the role of heat energy in weather-related phenomena including thunderstorms and hurricanes. 	

Grade Six Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>6.4 The student will investigate and understand that all matter is made up of atoms. Key concepts include</p> <ul style="list-style-type: none"> a) atoms are made up of electrons, protons, and neutrons; b) atoms of any element are alike but are different from atoms of other elements; c) elements may be represented by chemical symbols; d) two or more atoms may be chemically combined; e) compounds may be represented by chemical formulas; f) chemical equations can be used to model chemical changes; and g) a limited number of elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere. 	<p>6.5<u>4</u> The student will investigate and understand that all matter is made up of atoms. Key concepts include</p> <ul style="list-style-type: none"> a) atoms are made up of electrons, protons, and neutrons; b) atoms of any element are alike but are different from atoms of other elements; and • historical development and significance of discoveries related to the atom. c) <u>elements may be represented by chemical symbols;</u> d) <u>two or more atoms may be chemically combined;</u> e) <u>compounds may be represented by chemical formulas;</u> f) <u>chemical equations can be used to model chemical changes; and</u> g) <u>a limited number of elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere.</u>
<p>6.5 The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment. Key concepts include</p> <ul style="list-style-type: none"> a) water as the universal solvent; b) the properties of water in all three states; c) the action of water in physical and chemical weathering; d) the ability of large bodies of water to store heat and moderate climate; e) the origin and occurrence of water on Earth; f) the importance of water for agriculture, power generation, and public health; and g) the importance of protecting and maintaining water resources. 	

Grade Six Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>6.6 The student will investigate and understand the properties of air and the structure and dynamics of the Earth's atmosphere. Key concepts include</p> <ul style="list-style-type: none"> a) air as a mixture of gaseous elements and compounds; b) air pressure, temperature, and humidity; c) how the atmosphere changes with altitude; d) natural and human-caused changes to the atmosphere; e) the relationship of atmospheric measures and weather conditions; f) basic information from weather maps including fronts, systems, and basic measurements; and g) the importance of protecting and maintaining air quality. 	<p>6.6 The student will investigate and understand how to classify materials as elements, compounds, or mixtures. Key concepts include</p> <ul style="list-style-type: none"> • mixtures can be separated by physical processes; • compounds can only be separated by chemical processes; and • elements cannot be separated by physical or chemical means. <p style="text-align: center;"><i>(Concepts in 5.4, PS.2, PS.5.)</i></p>
<p>6.7 The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include</p> <ul style="list-style-type: none"> a) the health of ecosystems and the abiotic factors of a watershed; b) the location and structure of Virginia's regional watershed systems; c) divides, tributaries, river systems, and river and stream processes; d) wetlands; e) estuaries; f) major conservation, health, and safety issues associated with watersheds; and g) water monitoring and analysis using field equipment including hand-held technology. 	<p>6.7 The student will investigate and understand that matter has physical and chemical properties and can undergo change. Key concepts include</p> <ul style="list-style-type: none"> • physical changes; and • changes in chemical composition, including oxidation reactions (rusting and burning), photosynthesis, and acid-base neutralization reactions. <p style="text-align: center;"><i>(Concepts in PS.5.)</i></p>

Grade Six Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
	<p>6.8 The student will investigate and understand that organisms perform life processes that are essential for the survival and perpetuation of the species. Key concepts include</p> <ul style="list-style-type: none"> • energy transformation (from food or photosynthesis); and • respiration, movement, waste removal, growth, irritability (response), and reproduction. <p><i>(Concepts included in LS.4)</i></p>
	<p>6.9 The student will investigate and understand that organisms depend on other organisms and the nonliving components of the environment. Key concepts include</p> <ul style="list-style-type: none"> • producers, consumers, and decomposers; • food webs and food pyramids; and • cycles (water, carbon dioxide/oxygen, nitrogen). <p><i>(Concepts included in LS.9.)</i></p>

Grade Six Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>6.8 The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it. Key concepts include</p> <ul style="list-style-type: none"> a) the sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets; b) relative size of and distance between planets; c) the role of gravity; d) revolution and rotation; e) the mechanics of day and night and the phases of the moon; f) the unique properties of Earth as a planet; g) the relationship of the Earth's tilt and the seasons; h) the cause of tides; and i) the history and technology of space exploration. 	<p>6.408 The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it. Key concepts include</p> <ul style="list-style-type: none"> a) the, sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets; b) relative size of and distance between planets; c) the role of gravity; d) revolution and rotation; e) the mechanics of day and night and phases of the moon; f) <u>the unique properties of Earth as a planet;</u> g) the relationship of the Earth's tilt and seasons; h) the cause of tides; and i) the history and technology of space exploration.
<p>6.9 The student will investigate and understand public policy decisions relating to the environment. Key concepts include</p> <ul style="list-style-type: none"> a) management of renewable resources (water, air, soil, plant life, animal life); b) management of nonrenewable resources (coal, oil, natural gas, nuclear power, mineral resources); c) the mitigation of land-use and environmental hazards through preventive measures; and d) cost/benefit tradeoffs in conservation policies. 	<p>6.449 The student will investigate and understand public policy decisions relating to the environment. Key concepts include</p> <ul style="list-style-type: none"> a) management of renewable resources (water, air, <u>soil</u>, plant life, animal life); b) management of nonrenewable resources (coal, oil, natural gas, nuclear power, <u>mineral resources</u>); and c) <u>the mitigation of land-use and environmental hazards through preventive measures; and</u> d) cost/benefit tradeoffs in conservation policies.

Life Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>LS.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) data are organized into tables showing repeated trials and means; b) variables are defined; c) metric units (SI—International System of Units) are used; d) models are constructed to illustrate and explain phenomena; e) sources of experimental error are identified; f) dependent variables, independent variables, and constants are identified; g) variables are controlled to test hypotheses, and trials are repeated; h) continuous line graphs are constructed, interpreted, and used to make predictions; i) interpretations from a set of data are evaluated and defended; and j) an understanding of the nature of science is developed and reinforced. 	<p>LS.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) data are organized into tables showing repeated trials and means; b) variables are defined; c) <u>metric units (SI – International System of Units)</u>SI (metric) units are used; • criteria are established for evaluating a prediction; d) models are constructed to illustrate and explain phenomena; e) sources of experimental error are identified; f) dependent variables, independent variables, and constants are identified; g) variables are controlled to test hypotheses and trials are repeated; h) continuous line graphs are constructed, interpreted, and used to make predictions; and i) interpretations from the same set of data are evaluated and defended; <u>and</u> j) <u>an understanding of the nature of science is developed and reinforced.</u>

Life Science Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>LS.2 The student will investigate and understand that all living things are composed of cells. Key concepts include</p> <ul style="list-style-type: none"> a) cell structure and organelles (cell membrane, cell wall, cytoplasm, vacuole, mitochondrion, endoplasmic reticulum, nucleus, and chloroplast); b) similarities and differences between plant and animal cells; c) development of cell theory; and d) cell division (mitosis and meiosis). 	<p>LS.2 The student will investigate and understand that all living things are composed of cells. Key concepts include</p> <ul style="list-style-type: none"> a) cell structure and organelles (cell membrane, cell wall, cytoplasm, vacuole, mitochondrion, endoplasmic reticulum, nucleus and chloroplast); b) similarities and differences between plant and animal cells; c) development of cell theory; and d) cell division (mitosis and meiosis).
<p>LS.3 The student will investigate and understand that living things show patterns of cellular organization. Key concepts include</p> <ul style="list-style-type: none"> a) cells, tissues, organs, and systems; and b) life functions and processes of cells, tissues, organs, and systems (respiration, removal of wastes, growth, reproduction, digestion, and cellular transport). 	<p>LS.3 The student will investigate and understand that living things show patterns of cellular organization. Key concepts include</p> <ul style="list-style-type: none"> a) cells, tissues, organs, and systems; and b) <u>life</u> functions and processes of cells, tissues, organs, and systems (respiration, removal of wastes, growth, reproduction, digestion, and cellular transport).
<p>LS.4 The student will investigate and understand that the basic needs of organisms must be met in order to carry out life processes. Key concepts include</p> <ul style="list-style-type: none"> a) plant needs (light, water, gases, and nutrients); b) animal needs (food, water, gases, shelter, space); and c) factors that influence life processes. 	<p>LS.4 The student will investigate and understand that the basic needs of organisms must be met in order to carry out life processes. Key concepts include</p> <ul style="list-style-type: none"> a) plant needs (light and energy sources, water, gases, nutrients); b) animal needs (food, water, gases, shelter, space); and c) factors that influence life processes.

Life Science Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>LS.5 The student will investigate and understand how organisms can be classified. Key concepts include</p> <ul style="list-style-type: none"> a) the distinguishing characteristics of kingdoms of organisms; b) the distinguishing characteristics of major animal and plant phyla; and c) the characteristics of the species. 	<p>LS.5 The student will investigate and understand how classification of organisms can be classified. Key concepts include</p> <ul style="list-style-type: none"> • differences in number, color, size, shape, and texture of external and internal structures; and • variation in method of locomotion, obtaining nourishment, and reproduction. a) <u>distinguishing characteristics among kingdoms of organisms;</u> b) <u>distinguishing characteristics of major animal and plant phyla; and</u> c) <u>the characteristics of the species.</u>
<p>LS.6 The student will investigate and understand the basic physical and chemical processes of photosynthesis and its importance to plant and animal life. Key concepts include</p> <ul style="list-style-type: none"> a) energy transfer between sunlight and chlorophyll; b) transformation of water and carbon dioxide into sugar and oxygen; and c) photosynthesis as the foundation of virtually all food webs. 	<p>LS.6 The student will investigate and understand the basic physical and chemical processes of photosynthesis and its importance to plant and animal life. Key concepts include</p> <ul style="list-style-type: none"> a) energy transfer between sunlight and chlorophyll; b) transformation of water and carbon dioxide into sugar, water, and oxygen; and c) photosynthesis as the foundation of <u>virtually all</u> food webs.

Life Science Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>LS.7 The student will investigate and understand that organisms within an ecosystem are dependent on one another and on nonliving components of the environment. Key concepts include</p> <ul style="list-style-type: none"> a) the carbon, water, and nitrogen cycles; b) interactions resulting in a flow of energy and matter throughout the system; c) complex relationships within terrestrial, freshwater, and marine ecosystems; and d) energy flow in food webs and energy pyramids. 	<p>LS.7 The student will investigate and understand that organisms within an ecosystem are dependent on one another and on nonliving components of the environment. Key concepts include</p> <ul style="list-style-type: none"> a) <u>the carbon, water, and nitrogen cycles</u>; b) interactions resulting in a flow of energy and matter throughout the system; c) complex relationships <u>with</u>in terrestrial, freshwater, and marine ecosystems; and d) energy flow in food chains, food webs; and food <u>energy</u> pyramids.
<p>LS.8 The student will investigate and understand that interactions exist among members of a population. Key concepts include</p> <ul style="list-style-type: none"> a) competition, cooperation, social hierarchy, territorial imperative; and b) influence of behavior on a population 	<p>LS.8 The student will investigate and understand that interactions exist among members of a population. Key concepts include</p> <ul style="list-style-type: none"> a) competition, cooperation, social hierarchy, territorial imperative; and b) influence of behavior on <u>a population</u>-interactions.

Life Science Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>LS.9 The student will investigate and understand interactions among populations in a biological community. Key concepts include</p> <ul style="list-style-type: none"> a) the relationships among producers, consumers, and decomposers in food webs; b) the relationship between predators and prey; c) competition and cooperation; d) symbiotic relationships; and e) niches. 	<p>LS.9 The student will investigate and understand interactions among populations in a biological community. Key concepts include</p> <ul style="list-style-type: none"> a) the relationship among producers, consumers, and decomposers in food chains and food webs; b) the relationship of predators and prey; c) competition and cooperation; d) symbiotic relationships and niches; and e) <u>niches</u>. • the role of parasites and their hosts.
<p>LS.10 The student will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem. Key concepts include</p> <ul style="list-style-type: none"> a) differences between ecosystems and biomes; b) characteristics of land, marine, and freshwater ecosystems; and c) adaptations that enable organisms to survive within a specific ecosystem. 	<p>LS.10 The student will investigate and understand how organisms adapt to biotic and abiotic factors in an <u>biome</u> ecosystem. Key concepts include</p> <ul style="list-style-type: none"> a) differences between ecosystems and biomes; b) characteristics of land, marine, and freshwater biomes <u>ecosystems</u>; and c) adaptations that enable organisms to survive within a specific biome <u>ecosystem</u>.

Life Science Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>LS.11 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time (daily, seasonal, and long term). Key concepts include</p> <ul style="list-style-type: none"> a) phototropism, hibernation, and dormancy; b) factors that increase or decrease population size; and c) eutrophication, climate changes, and catastrophic disturbances. 	<p>LS.11 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time (daily, seasonal, and long term). Key concepts include</p> <ul style="list-style-type: none"> a) phototropism, hibernation, and dormancy; b) factors that increase or decrease population size; and c) eutrophication, climate change, and catastrophic disturbances.
<p>LS.12 The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include</p> <ul style="list-style-type: none"> a) food production and harvest; b) change in habitat size, quality, or structure; c) change in species competition; d) population disturbances and factors that threaten or enhance species survival; and e) environmental issues (water supply, air quality, energy production, and waste management). 	<p>LS.12 The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include</p> <ul style="list-style-type: none"> a) food production and harvest; b) change in habitat size, quality, and structure; c) change in species competition; d) population disturbances and factors that threaten and enhance species survival; and e) environmental issues (water supply, air quality, energy production, and waste management).

Life Science Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>LS.13 The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key concepts include</p> <ul style="list-style-type: none"> a) the role of DNA; b) the function of genes and chromosomes; c) genotypes and phenotypes; d) factors affecting the expression of traits; e) characteristics that can and cannot be inherited; f) genetic engineering and its applications; and g) historical contributions and significance of discoveries related to genetics. 	<p>LS.13 The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key concepts include</p> <ul style="list-style-type: none"> a) the role of DNA; b) <u>the function of genes and chromosomes;</u> c) <u>genotypes and phenotypes;</u> d) <u>factors affecting the expression of traits;</u> e) characteristics that can and cannot be inherited; f) genetic engineering and its applications; and g) historical contributions and significance of discoveries related to genetics.
<p>LS.14 The student will investigate and understand that organisms change over time. Key concepts include</p> <ul style="list-style-type: none"> a) the relationships of mutation, adaptation, natural selection, and extinction; b) evidence of evolution of different species in the fossil record; and c) how environmental influences, as well as genetic variation, can lead to diversity of organisms.. 	<p>LS.14 The student will investigate and understand that organisms change over time. Key concepts include</p> <ul style="list-style-type: none"> a) the relationships of mutation, adaptation, natural selection, and extinction; b) evidence of evolution of different species in the fossil record; and c) how environmental influences, as well as genetic variation, can lead to diversity of organisms.

Physical Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>PS.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) chemicals and equipment are used safely; b) length, mass, volume, density, temperature, weight, and force are accurately measured and reported using metric units (SI—International System of Units); c) conversions are made among metric units, applying appropriate prefixes; d) triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and spring scales are used to gather data; e) numbers are expressed in scientific notation where appropriate; f) research skills are utilized using a variety of resources; g) independent and dependent variables, constants, controls, and repeated trials are identified; h) data tables showing the independent and dependent variables, derived quantities, and the number of trials are constructed and interpreted; i) data tables for descriptive statistics showing specific measures of central tendency, the range of the data set, and the number of repeated trials are constructed and interpreted; j) frequency distributions, scattergrams, line plots, and histograms are constructed and interpreted; k) valid conclusions are made after analyzing data; l) research methods are used to investigate practical problems and questions; m) experimental results are presented in appropriate written form; and n) an understanding of the nature of science is developed and reinforced. 	<p>PS.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) <u>chemicals and equipment are used safely;</u> b) length, mass, volume, density, temperature, weight, and force are accurately measured and reported using the International System of Units (SI - metric); c) <u>conversions are made among metric units applying appropriate prefixes;</u> d) triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and spring scales are used to gather data; e) <u>numbers are expressed in scientific notation where appropriate;</u> • data from experiments are recorded and interpreted from bar, line, and circle graphs; f) research skills are utilized using a variety of resources; g) independent and dependent variables, constants, controls, and repeated trials are identified; h) <u>data tables showing the independent and dependent variables, derived quantities, and the number of trials are constructed and interpreted;</u> i) <u>data tables for descriptive statistics showing specific measures of central tendency, the range of the data set, and the number of repeated trials are constructed and interpreted;</u> j) <u>frequency distributions, scattergrams, line plots, and histograms are constructed and interpreted;</u> k) valid conclusions are made after analyzing data; l) research methods are used to investigate practical problems and questions; and m) experimental results are presented in appropriate written form; and n) <u>an understanding of the nature of science is developed and reinforced.</u>

*Strikethroughs indicate deletions; underlines indicate additions.

Physical Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>PS.2 The student will investigate and understand the basic nature of matter. Key concepts include</p> <ul style="list-style-type: none"> a) the particle theory of matter; b) elements, compounds, mixtures, acids, bases, and salts; c) solids, liquids, and gases; d) characteristics of types of matter based on physical and chemical properties; e) physical properties (shape, density, solubility, odor, melting point, boiling point, color); and f) chemical properties (acidity, basicity, combustibility, reactivity). 	<p>PS.2 The student will investigate and understand the basic nature of matter. Key concepts include</p> <ul style="list-style-type: none"> a) the particle theory of matter; b) elements, compounds, mixtures, acids, bases, <u>and</u> salts; organic, inorganic; c) solids, liquids, and gases; d) characteristics of types of matter based on physical and chemical properties; e) physical properties (shape, density, solubility, odor, melting point, boiling point, color); and f) chemical properties (acidity, basicity, combustibility, reactivity).
<p>PS.3 The student will investigate and understand the modern and historical models of atomic structure. Key concepts include</p> <ul style="list-style-type: none"> a) the contributions of Dalton, Thomson, Rutherford, and Bohr in understanding the atom; and b) the modern model of atomic structure. 	<p>PS.3 The student will investigate and understand various the <u>modern and historical</u> models of atomic structure including the Bohr and Cloud (quantum) models. <u>Key concepts include</u></p> <ul style="list-style-type: none"> a) <u>the contributions of Dalton, Thomson, Rutherford, and Bohr in understanding the atom; and</u> b) <u>the modern model of atomic structure.</u>
<p>PS.4 The student will investigate and understand the organization and use of the periodic table of elements to obtain information. Key concepts include</p> <ul style="list-style-type: none"> a) symbols, atomic number, atomic mass, chemical families (groups), and periods; b) classification of elements as metals, metalloids, and nonmetals; and c) simple compounds (formulas and the nature of bonding). 	<p>PS.4 The student will investigate and understand how to use the <u>organization and use of the</u> periodic table of elements to obtain information. Key concepts include</p> <ul style="list-style-type: none"> a) symbols, atomic numbers, atomic mass, chemical families (<u>groups</u>), <u>and</u> periods, valence numbers; b) <u>classification of elements as metals, metalloids, and nonmetals; and</u> c) binary-simple <u>compounds (chemical activity, physical properties, formulas, and nature of bonding).</u>

*Strikethroughs indicate deletions; underlines indicate additions.

Physical Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>PS.5 The student will investigate and understand changes in matter and the relationship of these changes to the Law of Conservation of Matter and Energy. Key concepts include</p> <ul style="list-style-type: none"> a) physical changes; b) nuclear reactions (products of fusion and fission and the effect of these products on humans and the environment); and a) chemical changes (types of reactions, reactants, and products; and balanced equations). 	<p>PS.5 The student will investigate and understand changes in matter and the relationship of these changes to the Law of Conservation of Matter and Energy. Key concepts include</p> <ul style="list-style-type: none"> a) physical changes (effect of temperature on state, particle size on solubility, and temperature on solubility); b) nuclear reactions (products of fusion and fission and their effects on human beings and the environment); and c) chemical changes (types of reactions, reactants and products, and balanced equations).
<p>PS.6 The student will investigate and understand states and forms of energy and how energy is transferred and transformed. Key concepts include</p> <ul style="list-style-type: none"> a) potential and kinetic energy; b) mechanical, chemical, and electrical energy; and a) heat, light, and sound. 	<p>PS.6 The student will investigate and understand states and forms of energy and how energy is transferred and transformed. Key concepts include</p> <ul style="list-style-type: none"> a) potential and kinetic energy; b) mechanical, chemical, and electrical energy; and c) heat, light, and sound..
<p>PS.7 The student will investigate and understand temperature scales, heat, and heat transfer. Key concepts include</p> <ul style="list-style-type: none"> a) Celsius and Kelvin temperature scales and absolute zero; b) phase change, freezing point, melting point, boiling point, vaporization, and condensation; c) conduction, convection, and radiation; and d) applications of heat transfer (heat engines, thermostats, refrigeration, and heat pumps). 	<p>PS.7 The student will investigate and understand temperature scales, heat, and heat transfer. Key concepts include</p> <ul style="list-style-type: none"> a) <u>Celsius and Kelvin temperature scales and absolute zero</u>; b) absolute zero, phase change, freezing point, melting point, boiling point, conduction, convection, radiation, vaporization, and condensation; and c) <u>conduction, convection, radiation, and</u> d) applications of heat transfer (heat engines, thermostats, and <u>refrigeration, and heat pumps</u>).

Physical Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>PS.8 The student will investigate and understand characteristics of sound and technological applications of sound waves. Key concepts include</p> <ul style="list-style-type: none"> a) wavelength, frequency, speed, and amplitude; b) resonance; c) the nature of mechanical waves; and d) technological applications of sound. 	<p>PS.8 The student will investigate and understand characteristics of sound and technological applications of sound waves. Key concepts include</p> <ul style="list-style-type: none"> a) wavelength, frequency, <u>speed, and</u> amplitude; interference; and b) <u>resonance</u>; c) <u>the nature of mechanical waves; and</u> d) technological applications of sound.
<p>PS.9 The student will investigate and understand the nature and technological applications of light. Key concepts include</p> <ul style="list-style-type: none"> a) the wave behavior of light (reflection, refraction, diffraction, and interference); b) images formed by lenses and mirrors; and c) the electromagnetic spectrum. 	<p>PS.9 The student will investigate and understand the nature and technological applications of light. Key concepts include</p> <ul style="list-style-type: none"> a) <u>the wave behavior of light</u> (reflection, refraction, particle theory, and wave theory <u>diffraction, and interference</u>); and b) <u>images formed by lenses and mirrors; and</u> c) <u>the electromagnetic spectrum.</u>
<p>PS.10 The student will investigate and understand scientific principles and technological applications of work, force, and motion. Key concepts include</p> <ul style="list-style-type: none"> a) speed, velocity, and acceleration; b) Newton's laws of motion; c) work, force, mechanical advantage, efficiency, and power; and d) applications (simple machines, compound machines, powered vehicles, rockets, and restraining devices). 	<p>PS.10 The student will investigate and understand scientific principles and technological applications of work, force, and motion. Key concepts include</p> <ul style="list-style-type: none"> a) <u>speed, velocity, and acceleration</u>; b) <u>Newton's Laws of Motion</u>; c) work, force, mechanical advantage, efficiency, <u>and</u> power, horsepower, gravitational force, speed/velocity, mass/weight, Newton's three laws of motion, acceleration; and d) applications (simple machines, compound machines, powered vehicles, rockets, <u>and</u> restraining devices; projectiles).

Physical Science Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>PS.11 The student will investigate and understand basic principles of electricity and magnetism. Key concepts include</p> <ul style="list-style-type: none"> a) static electricity, current electricity, and circuits; b) magnetic fields and electromagnets; and c) motors and generators. 	<p>PS.11 The student will investigate and understand basic principles of electricity and magnetism. Key concepts include</p> <ul style="list-style-type: none"> a) static, current, circuits; and b) magnetic fields and electromagnets-; <u>and</u> c) <u>motors and generators.</u>

Earth Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>ES.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) volume, area, mass, elapsed time, direction, temperature, pressure, distance, density, and changes in elevation/depth are calculated utilizing the most appropriate tools; b) technologies including computers, probeware, and global positioning systems (GPS), are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions; c) scales, diagrams, maps, charts, graphs, tables, and profiles are constructed and interpreted; d) variables are manipulated with repeated trials; and e) a scientific viewpoint is constructed and defended (the nature of science). 	<p>ES.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) volume, area, mass, elapsed time, direction, temperature, pressure, distance, density, and changes in elevation/depth are calculated utilizing the most appropriate tools; b) technologies, including computers, <u>probeware, and global positioning systems (GPS)</u> are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions; c) scales, diagrams, maps, charts, graphs, tables, and profiles are constructed and interpreted; d) variables are manipulated with repeated trials; and e) a scientific viewpoint is constructed and defended (<u>the nature of science</u>). f)
<p>ES.2 The student will demonstrate scientific reasoning and logic by</p> <ul style="list-style-type: none"> a) analyzing how science explains and predicts the interactions and dynamics of complex Earth systems; b) recognizing that evidence is required to evaluate hypotheses and explanations; c) comparing different scientific explanations for a set of observations about the Earth; d) explaining that observation and logic are essential for reaching a conclusion; and e) evaluating evidence for scientific theories. 	<p>ES.2 The student will demonstrate scientific reasoning and logic by</p> <ul style="list-style-type: none"> a) analyzing how science explains and predicts the interactions and dynamics of complex Earth systems; b) recognizing that evidence is required to evaluate hypotheses and explanations; c) comparing different scientific explanations for the same observations about the Earth; d) explaining that observation and logic are essential for reaching a conclusion; <u>and</u> e) evaluating evidence for scientific theories <u>related to plate tectonics, the structure of the Earth, and its ancient age and origin; and</u> f) <u>making informed judgments related to resource use and its effects on Earth systems (Moved to ES.7)</u>

Earth Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>ES.3 The student will investigate and understand how to read and interpret maps, globes, models, charts, and imagery. Key concepts include</p> <ul style="list-style-type: none"> a) maps (bathymetric, geologic, topographic, and weather) and star charts; b) imagery (aerial photography and satellite images); c) direction and measurements of distance on any map or globe; and d) location by latitude and longitude and topographic profiles. 	<p>ES.3 The student will investigate and understand how to read and interpret maps, globes, models, charts, and imagery. Key concepts include</p> <ul style="list-style-type: none"> a) maps (bathymetric, geologic, topographic, and weather) and star charts; b) imagery (aerial photography and satellite images); c) direction and distance measurements on any map or globe; and d) location by latitude and longitude and topographic profiles.
<p>ES.4 The student will investigate and understand the characteristics of the Earth and the solar system. Key concepts include</p> <ul style="list-style-type: none"> a) position of the Earth in the solar system; b) sun-Earth-moon relationships (seasons, tides, and eclipses); c) characteristics of the sun, planets and their moons, comets, meteors, and asteroids; and d) the history and contributions of the space program. 	<p>ES.4 The student will investigate and understand the characteristics of the Earth including <u>and the solar system.</u> Key concepts include</p> <ul style="list-style-type: none"> • plate tectonics; <i>(Included in ES.8)</i> • water in all three states; a) position of the Earth in the solar system; and • effects of density differences and energy transfer on the activities of the atmosphere, oceans, and Earth's interior. (moved to various other standards) b) <u>sun-Earth-moon relationships (seasons, tides, and eclipses); and</u> c) <u>characteristics of the sun, planets, their moons, comets, meteors, and asteroids; and</u> d) <u>the history and contribution of the space program.</u> <i>(Moved from ES.14)</i>

Earth Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>ES.5 The student will investigate and understand how to identify major rock-forming and ore minerals based on physical and chemical properties. Key concepts include</p> <ul style="list-style-type: none"> a) hardness, color and streak, luster, cleavage, fracture, and unique properties; and b) uses of minerals. 	<p>ES.5 The student will investigate and understand how to identify major rock-forming and ore minerals based on physical and chemical properties. Key concepts include</p> <ul style="list-style-type: none"> a) properties including hardness, color and streak, luster, cleavage, fracture, and unique properties; and b) uses of minerals.
<p>ES.6 The student will investigate and understand the rock cycle as it relates to the origin and transformation of rock types and how to identify common rock types based on mineral composition and textures. Key concepts include</p> <ul style="list-style-type: none"> a) igneous (intrusive and extrusive) rocks; b) sedimentary (clastic and chemical) rocks; and c) metamorphic (foliated and unfoliated) rocks. 	<p>ES.6 The student will investigate and understand how to identify common rock types based on mineral composition and textures and the rock cycle as it relates to the <u>origin and</u> transformation of rock types. Key concepts include</p> <ul style="list-style-type: none"> a) igneous (intrusive and extrusive); b) sedimentary (clastic and chemical); and c) metamorphic (foliated and unfoliated) rocks.
<p>ES.7 The student will investigate and understand the differences between renewable and nonrenewable resources. Key concepts include</p> <ul style="list-style-type: none"> a) fossil fuels, minerals, rocks, water, and vegetation; b) advantages and disadvantages of various energy sources; c) resources found in Virginia; d) making informed judgments related to resource use and its effects on Earth systems; and e) environmental costs and benefits. 	<p>ES.7 The student will investigate and understand the differences between renewable and nonrenewable resources. Key concepts include</p> <ul style="list-style-type: none"> a) fossil fuels, minerals, rocks, water, and vegetation; b) advantages and disadvantages of various energy sources; c) resources found in Virginia; • use of resources and their effects on standards of living; and d) <u>making informed judgments related to resource use and its effects on Earth systems; and</u> (<i>Moved from ES.2</i>) e) environmental costs and benefits.

*Strikethroughs indicate deletions; underlines indicate additions.

Earth Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>ES.8 The student will investigate and understand geologic processes including plate tectonics. Key concepts include</p> <ul style="list-style-type: none"> a) how geologic processes are evidenced in the physiographic provinces of Virginia including the Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateau; b) processes (faulting, folding, volcanism, metamorphism, weathering, erosion, deposition, and sedimentation) and their resulting features; and c) tectonic processes (subduction, rifting and sea floor spreading, and continental collision). 	<p>ES.8 The student will investigate and understand geologic processes including plate tectonics. Key concepts include</p> <ul style="list-style-type: none"> a) how geologic processes are evidenced in the physiographic provinces of Virginia including the Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateau; b) processes (faulting, folding, volcanism, metamorphism, weathering, erosion, deposition, and sedimentation) and their resulting features; and c) tectonic processes (subduction, rifting and sea floor spreading, and continental collision).
<p>ES.9 The student will investigate and understand how freshwater resources are influenced by geologic processes and the activities of humans. Key concepts include</p> <ul style="list-style-type: none"> a) processes of soil development; b) development of karst topography; c) identification of groundwater zones including the water table, zone of saturation, and zone of aeration; d) identification of other sources of fresh water including rivers, springs, and aquifers with reference to the hydrologic cycle; e) dependence on freshwater resources and the effects of human usage on water quality; and f) identification of the major watershed systems in Virginia including the Chesapeake Bay and its tributaries 	<p>ES.9 The student will investigate and understand how freshwater resources are influenced by geologic processes and the activities of humans. Key concepts include</p> <ul style="list-style-type: none"> a) processes of soil development; b) development of karst topography; c) identification of groundwater zones including water table, zone of saturation, and zone of aeration; d) identification of other sources of fresh water including <u>rivers, springs, and</u> aquifers with reference to the hydrologic cycle; and e) dependence on freshwater resources and the effects of human usage on water quality; and f) <u>identification of the major watersheds systems in Virginia including the Chesapeake Bay and its tributaries.</u>

*Strikethroughs indicate deletions; underlines indicate additions.

Earth Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>ES.10 The student will investigate and understand that many aspects of the history and evolution of the Earth and life can be inferred by studying rocks and fossils. Key concepts include</p> <ul style="list-style-type: none"> a) traces and remains of ancient, often extinct, life are preserved by various means in many sedimentary rocks; b) superposition, cross-cutting relationships, index fossils, and radioactive decay are methods of dating bodies of rock; c) absolute and relative dating have different applications but can be used together to determine the age of rocks and structures; and d) rocks and fossils from many different geologic periods and epochs are found in Virginia. 	<p>ES.10 The student will investigate and understand that many aspects of the history and evolution of the Earth and life can be inferred by studying rocks and fossils. Key concepts include</p> <ul style="list-style-type: none"> a) traces or remains of ancient, often extinct, life are preserved by various means in many sedimentary rocks; b) superposition, cross-cutting relationships, <u>index fossils</u>, and radioactive decay are methods of dating bodies of rock; c) absolute and relative dating have different applications but can be used together to determine the age of rocks and structures; and d) rocks and fossils from many different geologic periods and epochs are found in Virginia.
<p>ES.11 The student will investigate and understand that oceans are complex, interactive physical, chemical, and biological systems and are subject to long- and short-term variations. Key concepts include</p> <ul style="list-style-type: none"> a) physical and chemical changes (tides, waves, currents, sea level and ice cap variations, upwelling, and salinity variations); b) importance of environmental and geologic implications; c) systems interactions (density differences, energy transfer, weather, and climate); d) features of the sea floor (continental margins, trenches, mid-ocean ridges, and abyssal plains) as reflections of tectonic processes; and e) economic and public policy issues concerning the oceans and the coastal zone including the Chesapeake Bay. 	<p>ES.11 The student will investigate and understand that oceans are complex, interactive physical, chemical, and biological systems and are subject to long- and short-term variations. Key concepts include</p> <ul style="list-style-type: none"> a) physical and chemical changes (tides, waves, currents, sea level and ice cap variations, upwelling, and salinity concentrations); b) importance of environmental and geologic, and economic implications; c) systems interactions (<u>density differences</u>, energy transfer, weather, and climate); d) features of the sea floor (continental margins, trenches, mid-ocean ridges, and abyssal plains) reflect tectonic processes; and e) <u>economic and public policy issues concerning the oceans and the coastal zone including the Chesapeake Bay.</u>

*Strikethroughs indicate deletions; underlines indicate additions.

Earth Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>ES.12 The student will investigate and understand the origin and evolution of the atmosphere and the interrelationship of geologic processes, biologic processes, and human activities on its composition and dynamics. Key concepts include</p> <ul style="list-style-type: none"> a) scientific evidence for atmospheric changes over geologic time; b) current theories related to the effects of early life on the chemical makeup of the atmosphere; c) comparison of the Earth's atmosphere to that of other planets; d) atmospheric regulation mechanisms including the effects of density differences and energy transfer; and e) potential atmospheric compositional changes due to human, biologic, and geologic activity. 	<p>ES.12 The student will investigate and understand the origin and evolution of the atmosphere and the interrelationship of geologic processes, biologic processes, and human activities on its composition and dynamics. Key concepts include</p> <ul style="list-style-type: none"> a) scientific evidence for atmospheric changes over geologic time; b) current theories related to the effects of early life on the chemical makeup of the atmosphere; c) comparison of the Earth's atmosphere to that of other planets; d) atmospheric regulation mechanisms including the effects of density differences and energy transfer; and e) potential atmospheric compositional changes due to human, biologic, and geologic activity.
<p>ES.13 The student will investigate and understand that energy transfer between the sun and the Earth and its atmosphere drives weather and climate on Earth. Key concepts include</p> <ul style="list-style-type: none"> a) observation and collection of weather data; b) prediction of weather patterns; c) severe weather occurrences, such as tornadoes, hurricanes, and major storms; and d) weather phenomena and the factors that affect climate including radiation and convection. 	<p>ES.13 The student will investigate and understand that energy transfer between the sun, Earth, and the Earth's atmosphere drives weather and climate on Earth. Key concepts include</p> <ul style="list-style-type: none"> a) observation and collection of weather data; b) prediction of weather patterns; and c) <u>severe weather occurrences such as tornadoes, hurricanes, and major storms; and</u> d) weather phenomena and the factors that affect climate <u>including radiation and convection.</u>

Earth Science Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>ES.14 The student will investigate and understand scientific concepts related to the origin and evolution of the universe. Key concepts include</p> <ul style="list-style-type: none"> a) nebulae; b) the origin of stars and star systems; c) stellar evolution; d) galaxies; and e) cosmology including the big bang theory. 	<p>ES.14 The student will investigate and understand the planets and other members of the solar system; the history and contributions of the space program; and the scientific concepts related to the origin and evolution of the solar system, galaxy, and universe. Key concepts include</p> <ul style="list-style-type: none"> • characteristics of the sun, planets, their moons, comets, meteors, and asteroids; and (Moved to ES.4) a) <u>nebulae;</u> b) <u>the origin of stars and star systems;</u> c) <u>stellar evolution;</u> d) <u>galaxies; and</u> e) <u>cosmology (the Big Bang).</u> • cosmology and the origin of stars and stellar systems (the Big Bang, the solar nebular theory, stellar evolution, star systems, nebulae, constellations, and galaxies); and

Biology Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>BIO.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) observations of living organisms are recorded in the lab and in the field; b) hypotheses are formulated based on direct observations and information from scientific literature; c) variables are defined and investigations are designed to test hypotheses; d) graphing and arithmetic calculations are used as tools in data analysis; e) conclusions are formed based on recorded quantitative and qualitative data; f) sources of error inherent in experimental design are identified and discussed; g) validity of data is determined; h) chemicals and equipment are used in a safe manner; i) appropriate technology including computers, graphing calculators, and probeware, is used for gathering and analyzing data and communicating results; j) research utilizes scientific literature; k) differentiation is made between a scientific hypothesis and theory; l) alternative scientific explanations and models are recognized and analyzed; and m) a scientific viewpoint is constructed and defended (the nature of science). 	<p>BIO.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) observations of living things <u>organisms</u> are recorded in the lab and in the field; b) hypotheses are formulated based on <u>direct</u> observations and <u>information from the scientific literature</u>; c) variables are defined and investigations are designed to test hypotheses; d) graphing and arithmetic calculations are used as tools in data analysis; e) conclusions are formed based on recorded quantitative and qualitative data; f) impacts of sources of error inherent in experimental design are identified and discussed; g) validity of data is determined; h) alternative <u>scientific</u> explanations and models are recognized and analyzed; i) appropriate technology, <u>including computers, graphing calculators, and probeware</u>, is used for gathering and analyzing data and communicating results; and j) research is based on utilizes popular and scientific literature; k) <u>differentiation is made between a scientific hypothesis and theory</u>; l) <u>a scientific viewpoint is constructed and defended (the nature of science)</u>; and m) <u>chemicals and equipment are used in a safe manner</u>.

Biology Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>BIO.2 The student will investigate and understand the history of biological concepts. Key concepts include</p> <ul style="list-style-type: none"> a) evidence supporting the cell theory; b) scientific explanations of the development of organisms through time (biological evolution); c) evidence supporting the germ theory of infectious disease; d) development of the structural model of DNA; and e) the collaborative efforts of scientists, past and present. 	<p>BIO.2 The student will investigate and understand the history of biological concepts. Key concepts include</p> <ul style="list-style-type: none"> a) evidence supporting the cell theory; b) scientific explanations of the development of organisms through time (<u>biological evolution</u>); c) <u>evidence supporting the germ theory of infectious disease</u>; • causative agents of disease; d) <u>the evolution of the development of the structural model of DNA model</u>; and e) the collaborative efforts of scientists, past and present.
<p>BIO.3 The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include</p> <ul style="list-style-type: none"> a) water chemistry and its impact on life processes; b) the structure and function of macromolecules; c) the nature of enzymes; and d) the capture, storage, transformation, and flow of energy through the processes of photosynthesis and respiration. 	<p>BIO.3 The student will investigate and understand <u>the chemical and</u> biochemical principles essential for life. Key concepts include</p> <ul style="list-style-type: none"> a) water chemistry and its impact on life processes; b) the structure and function of macromolecules; c) the nature of enzymes; and d) <u>the significance of and relationship between the capture, storage, and transformation, and flow of energy through the processes of</u> photosynthesis and respiration.

Biology Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>BIO.4 The student will investigate and understand relationships between cell structure and function. Key concepts include</p> <ul style="list-style-type: none"> a) characteristics of prokaryotic and eukaryotic cells; b) exploring of the diversity and variation of eukaryotes; c) similarities between the activities of a single cell and a whole organism; and d) the cell membrane model (diffusion, osmosis, and active transport). 	<p>BIO.4 The student will investigate and understand relationships between cell structure and function. Key concepts include</p> <ul style="list-style-type: none"> a) <u>characteristics of prokaryotic and eukaryotic cells</u> characterizing prokaryotic organisms; b) exploring the diversity and variation of eukaryotes; c) building analogies <u>similarities</u> between the activities of a single cell and a whole organism; and d) modeling the cell membrane <u>model (diffusion, osmosis, and active transport)</u>. cell communication, and cell recognition.
<p>BIO.5 The student will investigate and understand life functions of archaeobacteria, monerans (eubacteria), protists, fungi, plants, and animals including humans. Key concepts include</p> <ul style="list-style-type: none"> a) how their structures and functions vary between and within the kingdoms; b) comparison of their metabolic activities; c) analyses of their responses to the environment; d) maintenance of homeostasis; e) human health issues, human anatomy, body systems, and life functions; and f) how viruses compare with organisms. 	<p>BIO.5 The student will investigate and understand life functions of archaeobacteria, <u>monerans (eubacteria)</u>, protists, fungi, plants, and animals, including humans. Key concepts include</p> <ul style="list-style-type: none"> a) how their structures <u>and function vary between and within the kingdoms</u>; are alike and different; b) comparison of their metabolic activities; c) analyses of their responses to the environment; d) maintenance of homeostasis; e) human health issues, human anatomy, body systems, and life functions; <u>and</u> f) how viruses compare with organisms; and <ul style="list-style-type: none"> • observation of local organisms when applicable.

Biology Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>BIO.6 The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include</p> <ul style="list-style-type: none"> a) cell growth and division; b) gamete formation; c) cell specialization; d) prediction of inheritance of traits based on the Mendelian laws of heredity; e) genetic variation (mutation, recombination, deletions, additions to DNA); f) the structure, function, and replication of nucleic acids (DNA and RNA); g) events involved in the construction of proteins; h) use, limitations, and misuse of genetic information; and i) exploration of the impact of DNA technologies. 	<p>BIO.6 The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include</p> <ul style="list-style-type: none"> a) cell <u>growth and</u> division; b) sex cell <u>gamete</u> formation; c) cell specialization; d) prediction of inheritance of traits based on the <u>Mendelian</u> laws of heredity; e) effects of <u>genetic variation (mutation, recombination, deletions, additions to DNA)</u> recombination and mutation; f) <u>the structure, function, and replication of nucleic acids (DNA and RNA)</u>; g) events involved in the construction of proteins; and h) <u>use, limitations, and misuse of genetic information</u>; and i) exploration of the impact of DNA technologies.
<p>BIO.7 The student will investigate and understand bases for modern classification systems. Key concepts include</p> <ul style="list-style-type: none"> a) structural similarities among organisms; b) fossil record interpretation; c) comparison of developmental stages in different organisms; d) examination of biochemical similarities and differences among organisms; and e) systems of classification that are adaptable to new scientific discoveries. 	<p>BIO.7 The student will investigate and understand bases for modern classification systems. Key concepts include</p> <ul style="list-style-type: none"> a) structural similarities in organisms; b) fossil record interpretation; c) comparison of developmental stages in different organisms; d) examination of <u>biochemical</u> protein similarities and differences among organisms; <u>and</u> • comparison of DNA sequences in organisms; e) systems of classification that are adaptable to new scientific discoveries; <u>and</u> • examination of local flora and fauna where applicable.

Biology Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>BIO.8 The student will investigate and understand how populations change through time. Key concepts include</p> <ul style="list-style-type: none"> a) evidence found in fossil records; b) how genetic variation, reproductive strategies, and environmental pressures impact the survival of populations; c) how natural selection leads to adaptations; d) emergence of new species; and e) scientific explanations for biological evolution. 	<p>BIO.8 The student will investigate and understand how populations change through time. Key concepts include</p> <ul style="list-style-type: none"> a) examining evidence found in fossil records; b) investigating how <u>genetic</u> variation of traits, reproductive strategies, and environmental pressures impact on the survival of populations; c) recognizing how natural selection leads to adaptations; and d) emergence of exploring how new species emerge; <u>and</u> e) <u>scientific explanations for biological evolution.</u>
<p>BIO.9 The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include</p> <ul style="list-style-type: none"> a) interactions within and among populations including carrying capacities, limiting factors, and growth curves; b) nutrient cycling with energy flow through ecosystems; c) succession patterns in ecosystems; d) the effects of natural events and human activities on ecosystems; and e) analysis of the flora, fauna, and microorganisms of Virginia ecosystems including the Chesapeake Bay and its tributaries. 	<p>BIO.9 The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include</p> <ul style="list-style-type: none"> a) interactions within and among populations including carrying capacities, limiting factors, and growth curves; b) nutrient cycling with energy flow through ecosystems; c) succession patterns in ecosystems; d) the effects of natural events and human influences on ecosystems; and e) analysis of <u>the local ecosystems, flora, fauna, and microorganisms of Virginia ecosystems including the Chesapeake Bay and its tributaries.</u>

Chemistry Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data. Key concepts include</p> <ul style="list-style-type: none"> a) designated laboratory techniques; b) safe use of chemicals and equipment; c) proper response to emergency situations; d) manipulation of multiple variables, using repeated trials; e) accurate recording, organization, and analysis of data through repeated trials; f) mathematical and procedural error analysis; g) mathematical manipulations (SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, dimensional analysis); h) use of appropriate technology including computers, graphing calculators, and probeware, for gathering data and communicating results; and i) construction and defense of a scientific viewpoint (the nature of science). 	<p>CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated, produce observations and verifiable data. Key concepts include</p> <ul style="list-style-type: none"> a) designated laboratory techniques; b) safe use of chemicals and equipment; c) proper response to emergency situations; d) <u>manipulation of multiple variables</u> are manipulated with repeated trials; e) accurate recording, organizing, and analysis of data through repeated trials; f) mathematical and procedural error analysis; and g) mathematical manipulations (SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, dimensional analysis, use of scientific calculator); h) <u>the use of appropriate technology including computers, graphing calculators, and probeware for gathering data and communicating results; and</u> i) <u>construction and defense of a scientific viewpoint (the nature of science).</u>

Chemistry Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>CH.2 The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of</p> <ul style="list-style-type: none"> a) average atomic mass, mass number, and atomic number; b) isotopes, half lives, and radioactive decay; c) mass and charge characteristics of subatomic particles; d) families or groups; e) series and periods; f) trends including atomic radii, electronegativity, shielding effect, and ionization energy; g) electron configurations, valence electrons, and oxidation numbers; h) chemical and physical properties; and i) historical and quantum models. 	<p>CH.2 The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of</p> <ul style="list-style-type: none"> a) <u>average atomic mass</u>, <u>mass number</u>, and atomic number; b) <u>isotopes</u>, <u>half lives</u>, and <u>radioactive decay</u>/half-lives/nuclear and subatomic particles; c) <u>characteristics of subatomic particles</u>/as to mass and charge; d) families/<u>or</u> groups; e) series/and periods; f) trends/patterns including: atomic/nuclear radii, electronegativity, shielding effect; <u>and ionization energy</u>; g) electron configurations/, <u>valence electrons</u>, and oxidation numbers; h) chemical/<u>and</u> physical properties; and i) historical/and quantum models.

Chemistry Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (*Changes Indicated)
<p>CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include</p> <ul style="list-style-type: none"> a) nomenclature; b) balancing chemical equations; c) writing chemical formulas (molecular, structural, and empirical; and Lewis diagrams); d) bonding types (ionic and covalent); e) reaction types (synthesis, decomposition, single and double replacement, oxidation-reduction, neutralization, exothermic, and endothermic); and f) reaction rates and kinetics (activation energy, catalysis, and degree of randomness). 	<p>CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include</p> <ul style="list-style-type: none"> a) nomenclature; b) balancing chemical equations; c) writing chemical formulas – (molecular, structural, empirical, and Lewis diagrams); d) bonding types – (ionic, covalent); e) reaction types – (synthesis, decomposition, single and double replacement, oxidation-reduction, neutralization, nuclear, exothermic and endothermic, spontaneous/non-spontaneous, dissociation ionization); <u>and</u> • physical and chemical equilibrium; and f) reaction rates and kinetics: (activation energy, catalysis, degree of randomness).
<p>CH.4 The student will investigate and understand that quantities in a chemical reaction are based on molar relationships. Key concepts include</p> <ul style="list-style-type: none"> a) Avogadro's principle and molar volume; b) stoichiometric relationships; c) partial pressure; d) gas laws; e) solution concentrations; f) chemical equilibrium; and g) acid/base theory: strong electrolytes, weak electrolytes, and nonelectrolytes; dissociation and ionization; pH and pOH; and the titration process. 	<p>CH.4 The student will investigate and understand that quantities in a chemical reaction are based on molar relationships. Key concepts include</p> <ul style="list-style-type: none"> a) aAvogadro's principle; <u>and</u> molar volume; b) stoichiometric relationships; c) partial pressure; d) gas laws; e) solution concentrations; f) chemical equilibrium; and g) acid/base theory: strong/ <u>electrolytes</u>, weak electrolytes, <u>and nonelectrolytes</u>; dissociation/ and ionization; (pH; <u>and</u> pOH); <u>and the titration process</u>.

Chemistry Standards of Learning

Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>CH.5 The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include</p> <ul style="list-style-type: none"> a) pressure, temperature, and volume; b) vapor pressure; c) phase changes; d) molar heats of fusion and vaporization; e) specific heat capacity; and f) colligative properties.. 	<p>CH.5 The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include</p> <ul style="list-style-type: none"> a) pressure, temperature, and volume; b) vapor pressure; • partial pressures; c) phase changes; d) molar heats of fusion and vaporization; e) specific heat capacity; <u>and</u> f) solutions; <u>and</u> (<i>Incorporated in CH.4e</i>) colligative properties.
	<p>CH.6 The student will investigate and understand how basic chemical principles relate to other areas of chemistry. Key concepts include</p> <ul style="list-style-type: none"> • organic and biochemistry; • nuclear chemistry; and • environmental chemistry.

Physics Standards of Learning **Crosswalk between the 2003 and 1995 Standards**

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>PH.1 The student will plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) the components of a system are defined; b) instruments are selected and used to extend observations and measurements of mass, volume, temperature, heat exchange, energy transformations, motion, fields, and electric charge; c) information is recorded and presented in an organized format; d) metric units are used in all measurements and calculations; e) the limitations of the experimental apparatus and design are recognized; f) the limitations of measured quantities are recognized through the appropriate use of significant figures or error ranges; g) data gathered from non-SI instruments are incorporated through appropriate conversions; and h) appropriate technology including computers, graphing calculators, and probeware, is used for gathering and analyzing data and communicating results. 	<p>PH.1 The student will investigate and understand how to plan and conduct investigations in which</p> <ul style="list-style-type: none"> a) the components of a system are defined; b) instruments are selected and used to extend observations and measurements of mass, volume, temperature, heat exchange, energy transformations, motion, fields, and electric charge; c) information is recorded and presented in an organized format; d) metric units are used in all measurements and calculations; e) the limitations of the experimental apparatus and design are recognized; f) the limitations of measured quantities through the appropriate use of significant figures or error ranges are recognized; and g) data gathered from non-SI instruments are incorporated through appropriate conversions; <u>and</u> h) <u>appropriate technology, including computers, graphing calculators, and probeware is used for gathering and analyzing data and communicating results.</u>

Physics Standards of Learning **Crosswalk between the 2003 and 1995 Standards**

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>PH.2 The student will investigate and understand how to analyze and interpret data. Key concepts include</p> <ul style="list-style-type: none"> a) a description of a physical problem is translated into a mathematical statement in order to find a solution; b) relationships between physical quantities are determined using the shape of a curve passing through experimentally obtained data; c) the slope of a linear relationship is calculated and includes appropriate units; d) interpolated, extrapolated, and analyzed trends are used to make predictions; and e) analysis of systems employs vector quantities utilizing trigonometric and graphical methods. 	<p>PH.2 The student will investigate and understand how to analyze and interpret data. Key concepts include</p> <ul style="list-style-type: none"> a) a description of a physical problem is translated into a mathematical statement in order to find a solution; b) relationships between physical quantities are determined using the shape of a curve passing through experimentally obtained data; c) the slope of a linear relationship is calculated and includes appropriate units; d) interpolated, extrapolated, and analyzed trends are used to make predictions; <u>and</u> • inferential statistical tests are applied in evaluating experimental data; <u>and</u> e) analysis of systems employs vector quantities utilizing trigonometric and graphical methods.
<p>PH.3 The student will investigate and understand how to demonstrate scientific reasoning and logic. Key concepts include</p> <ul style="list-style-type: none"> a) analysis of scientific sources to develop and refine research hypotheses; b) analysis of how science explains and predicts relationships; c) evaluation of evidence for scientific theories; d) examination of how new discoveries result in modification of existing theories or establishment of new paradigms; and e) construction and defense of a scientific viewpoint (the nature of science). 	<p>PH.3 The student will investigate and understand how to demonstrate scientific reasoning and logic. Key concepts include</p> <ul style="list-style-type: none"> a) analysis of <u>scientific</u> primary sources to develop and refine research hypotheses; b) analysis of how science explains and predicts relationships; and c) evaluation of evidence for scientific theories; and how new discoveries may either modify existing theories or result in establishing a new paradigm. d) <u>examination of how new discoveries result in modification of existing theories or establishment of new paradigms; and</u> e) <u>construction and defense of a scientific viewpoint (the nature of science).</u>

Physics Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>PH.4 The student will investigate and understand how applications of physics affect the world. Key concepts include</p> <ul style="list-style-type: none"> a) examples from the real world; and b) exploration of the roles and contributions of science and technology. 	<p>PH.4 The student will investigate and understand how applications of physics affect the world. Key concepts include</p> <ul style="list-style-type: none"> a) principles with examples from the real world; and b) exploration of the roles and contributions of science and technology.
<p>PH.5 The student will investigate and understand the interrelationships among mass, distance, force, and time through mathematical and experimental processes. Key concepts include</p> <ul style="list-style-type: none"> a) linear motion; b) uniform circular motion; c) projectile motion; d) Newton's laws of motion; e) gravitation; f) planetary motion; and g) work, power, and energy. 	<p>PH.5 The student will investigate and understand the interrelationships among mass, distance, force, and time through mathematical and experimental processes. Key concepts include</p> <ul style="list-style-type: none"> a) linear motion; b) uniform circular motion; c) curvilinear motion <u>projectile motion</u>; d) Newton's laws of motion; e) gravitation; f) celestial mechanics <u>planetary motion</u>; and g) work, power, and energy.
<p>PH.6 The student will investigate and understand that quantities including mass, energy, momentum, and charge, are conserved. Key concepts include</p> <ul style="list-style-type: none"> a) kinetic and potential energy; b) elastic and inelastic collisions; and c) electric power. 	<p>PH.6 The student will investigate and understand that quantities including mass, energy, momentum, and charge are conserved. Key concepts include</p> <ul style="list-style-type: none"> a) kinetic and potential energy; b) elastic and inelastic collisions; and c) electric power and circuit design.

Physics Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>PH.7 The student will investigate and understand properties of fluids. Key concepts include</p> <ul style="list-style-type: none"> a) density and pressure; b) variation of pressure with depth; c) Archimedes' principle of buoyancy; d) Pascal's principle; e) fluids in motion; and f) Bernoulli's principle. 	<p>PH.7 The student will investigate and understand that the kinetic molecular theory can be applied to solve quantitative problems involving pressure, volume, and temperature. <i>(Substantially duplicates CH.5)</i></p>
<p>PH.8 The student will investigate and understand that energy can be transferred and transformed to provide usable work. Key concepts include</p> <ul style="list-style-type: none"> a) transformation of energy among forms including mechanical, thermal, electrical, gravitational, chemical, and nuclear; and b) efficiency of systems. 	<p>PH.8 The student will investigate and understand that energy can be transferred and transformed to provide usable work. Key concepts include</p> <ul style="list-style-type: none"> a) transformation of energy among forms, including mechanical, thermal, electrical, gravitational, chemical, and nuclear; and b) efficiency of systems.
<p>PH.9 The student will investigate and understand how to use models of transverse and longitudinal waves to interpret wave phenomena. Key concepts include</p> <ul style="list-style-type: none"> a) wave characteristics (period, wavelength, frequency, amplitude, and phase); b) fundamental wave processes (reflection, refraction, diffraction, interference, polarization, Doppler effect); and c) light and sound in terms of wave models. 	<p>PH.9 The student will investigate and understand how to use models of transverse and longitudinal waves to interpret wave phenomena. Key concepts include</p> <ul style="list-style-type: none"> a) wave characteristics (period, wavelength, frequency, amplitude and phase); b) fundamental wave processes (reflection, refraction, diffraction, interference, standing waves, polarization, Doppler effect); and c) light and sound in terms of wave models.

Physics Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>PH.10 The student will investigate and understand that different frequencies and wavelengths in the electromagnetic spectrum are phenomena ranging from radio waves through visible light to gamma radiation. Key concepts include</p> <ul style="list-style-type: none"> a) the properties and behaviors of radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays; and b) current applications based on the wave properties of each band. 	<p>PH.10 The student will investigate and understand that different frequencies and wavelengths in the electromagnetic spectrum are phenomena ranging from radio waves through visible light to gamma radiation. Key concepts include</p> <ul style="list-style-type: none"> a) the properties and behaviors of radio, microwaves, infra-red, visible light, ultra-violet, X-rays, and gamma rays; and b) current applications based on the wave properties of each band.
<p>PH.11 The student will investigate and understand, in describing optical systems, how light behaves in the fundamental processes of reflection, refraction, and image formation. Key concepts include</p> <ul style="list-style-type: none"> a) application of the laws of reflection and refraction; b) construction and interpretation of ray diagrams; c) development and use of mirror and lens equations; and d) predictions of type, size, and position of real and virtual images. 	<p>PH.11 The student will investigate and understand how light behaves in the fundamental processes of reflection, refraction, and image formation in describing optical systems. Key concepts include</p> <ul style="list-style-type: none"> a) application of the laws of reflection and refraction; b) construction and interpretation of ray diagrams; c) development and use of mirror and lens equations; and d) predictions of type, size, and position of real and virtual images.

Physics Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>PH.12 The student will investigate and understand how to use the field concept to describe the effects of gravitational, electric, and magnetic forces. Key concepts include</p> <ul style="list-style-type: none"> a) inverse square laws (Newton's law of universal gravitation and Coulomb's law); and b) operating principles of motors, generators, transformers, and cathode ray tubes. 	<p>PH.12 The student will investigate and understand how to use the field concept to describe the effects of <u>gravitational</u>, electric, <u>and</u> magnetic, and gravitational forces. Key concepts include</p> <ul style="list-style-type: none"> a) inverse square laws (<u>Newton's law of universal gravitation and Coulomb's law</u>); <u>and</u> • Newton's law of universal gravitation; • Coulomb's law; <u>and</u> b) operating principles of motors, generators, <u>transformers</u>, and cathode ray tubes.
<p>PH.13 The student will investigate and understand how to diagram and construct basic electrical circuits and explain the function of various circuit components. Key concepts include</p> <ul style="list-style-type: none"> a) Ohm's law; b) series, parallel, and combined circuits; and c) circuit components including resistors, batteries, generators, fuses, switches, and capacitors. 	<p>PH.13 The student will investigate and understand how to diagram and construct basic electrical circuits and explain the function of various circuit components. Key concepts include</p> <ul style="list-style-type: none"> a) Ohm's law; and b) series, parallel, and combined circuits; <u>and</u> c) <u>circuit components including resistors, batteries, generators, fuses, switches, and capacitors.</u>

Physics Standards of Learning
Crosswalk between the 2003 and 1995 Standards

2003 Revised Science Standard of Learning	1995 Science Standard of Learning (<i>*Changes Indicated</i>)
<p>PH.14 The student will investigate and understand that extremely large and extremely small quantities are not necessarily described by the same laws as those studied in Newtonian physics. Key concepts include</p> <ul style="list-style-type: none"> a) wave/particle duality; b) wave properties of matter; c) matter/energy equivalence; d) quantum mechanics and uncertainty; e) relativity; f) nuclear physics; g) solid state physics; h) superconductivity; and i) radioactivity. 	<p>PH.14 The student will investigate and understand that extremely large and extremely small quantities are not necessarily described by the same laws as those studied in Newtonian physics. Key concepts include</p> <ul style="list-style-type: none"> a) wave/particle duality; b) wave properties of matter; c) matter/energy equivalence; d) quantum mechanics and uncertainty; e) relativity; f) nuclear physics; g) solid state physics; h) superconductivity; and i) radioactivity.